federal register

FRIDAY, SEPTEMBER 9, 1977

PART VII

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

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OCCUPATIONAL EXPOSURE TO 1,2 DIBROMO-3-CHLOROPROPANE (DBCP)

Emergency Temporary Standard; Hearing

Title 29—Labor

CHAPTER XVII—OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, DEPARTMENT OF LABOR

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Emergency Temporary Standard for Occupational Exposure to 1,2 Dibromo-3-chloropropane (DBCP); Hearing

AGENCY: Occupational Safety and Health Administration, Department of Labor.

ACTION: Emergency Temporary Standard; Notice of Hearing.

SUMMARY: This emergency temporary standard (ETS) is based on the determination that data conclusively establish that employee exposure to DBCP presents a hazard of sterility as well as cancer. Therefore, a grave danger currently exists for workers exposed to this sterility-inducing and cancer-causing substance. As a result, it is necessary to issue an emergency temporary standard to protect exposed employees. By this ETS the Occupational Safety and Health Administration (OSHA) limits employee exposure to DBCP to 10 parts DBCP per billion parts of air (10 ppb), as an 8 hour time-weighted average concentration, with a ceiling level of 50 ppb for any 15 minute period during the 8-hour day. In addition, the ETS requires the measurement of employee exposure, engineering controls, personal protective equipment and clothing, employee training, medical surveillance, work practices, and recordkeeping. The ETS will be superseded by a permanent standard within six months. A public hearing on the permanent standard will commence on December 6, 1977.

EFFECTIVE DATE: September 9, 1977.

FOR FURTHER INFORMATION CONTACT:

Ms. Flo Ryer, Directorate of Health Standards Programs, OSHA, Third Street and Constitution Avenue NW., Room N-3663, Washington, D.C. 20210 (202-523-7174).

SUPPLEMENTARY INFORMATION: The accompanying document is an emergency temporary standard issued pursuant to sections 6(c) and 8(c) of the Occupational Safety and Health Act of 1970 (the Act) (84 Stat. 1596, 1599; 29 U.S.C. 655, 657), the Secretary of Labor's Order No. 8-76 (41 FR 25059) and 29 CFR Part 1911. The new standard, § 1910.1044 applies to all employments in all industries covered by the Act, including "general industry", construction and maritime, excluding only agriculture.

Pursuant to section 6(c)(3) of the Act, OSHA will shortly commence a rulemaking proceeding under section 6(b) of the Act. The emergency temporary standard will serve as a proposed final rule, along with other proposed requirements which will be published in the FEDERAL REGISTER pursuant to 29 CFR 1911.12. OSHA will publish an additional proposal in the very near future encompassing those areas of occupational safety and health considered appropriate for the agency's permanent regulation of DBCP. This document sets a public hearing on the permanent DBCP standard to begin on December 6, 1977.

The development of a permanent standard will be conducted pursuant to the rulemaking procedures of section 6(b) of the Act. The Assistant Secretary's decisions on the provisions of the final standard will be based on the entire record developed, including public comments and the informal rulemaking hearing.

I. BACKGROUND

DBCP has been used as an agricultural nematocide since 1955. DBCP is a dense yellow or amber liquid with a pungent odor at high temperatures. It has a low vapor pressure (0.8 mm Hg at 200C) and slight solubility in water (1,000 ppm).

DBCP is produced primarily by the bromination of allyl chloride at room temperature, usually a vigorous reaction which requires cooling. DBCP is produced in the United States by Dow Chemical Co. and Shell Chemical Co. The Federal Republic of Germany and Israel also export DBCP to this country. About 12 million pounds of DBCP were consumed in 1972.

DBCP is shipped to formulators who reprocess the chemical into products for consumer use. Formulators may vary the concentration of the chemical in an end product or change its physical state by simple blending and mixing operations. DBCP is formulated into emulsifiable concentrates, liquid concentrates, powder, granules and solid material. Formulating granular DBCP involves spraying liquid DBCP onto inert granules. The formulation of liquid and emulsified DBCP concentrates can involve the following operations: Transferring technical grade DBCP from railroad tank cars to storage tanks, and from the storage tanks to a mixing tank, adding an emulsifier or solvent to the mixing tank, transferring the blended material to a holding tank and then to drums; other transferring operations take place during the packaging of the DBCP materials. About 80 formulators have labels registered with EPA for the approximately 160 products which contain DBCP. The complete distribution chain generally includes the manufacture of technical grade DBCP, formulation of DBCP pesticides, distribution of DBCP pesticide and the agricultural consumption of DBCP pesticide.

In 1961, the authors of a research paper, Torkelson, et al., recommended that occupational exposure to DBCP be limited to less than 1 ppm in air. There is currently no OSHA standard for DBCP, a chemical substance to which approximately 2,000 to 3,000 employees in facilities manufacturing and formulating DBCP have recently been or may currently be exposed.

In July of this year, a worker at the Occidental Chemical Plant in Lathrop, Calif., noted and complained of the inability to father a child. During discussions with fellow workers, it was discovered that several other workers were having a similar problem. These workers were tested and found to be sterile. (August 31, 1977 statement of Dr. Whorton.) As a result of this testing, on August 5, 1977, the Oil, Chemical and Atomic Workers (OCAW) union requested the National Institute for Occupational Safety and Health (NIOSH) to conduct a health hazard evaluation at the Occidental Chemical Co. Plant. This request was made after representatives of OCAW learned that a number of workers at this plant had abnormally low sperm counts.

On August 9 and 10, 1977, NIOSH conducted a walk-through inspection of the Lathrop plant and met with representatives from the company, the local union, and California OSHA. The NIOSH staff also met with Dr. Donald Whorton, University of California, Berkeley, who had consulted previously with the company and the union and who had conducted medical examinations of the affected employees. Medical examinations of a number of additional employees have subsequently been conducted by NIOSH staff in conjunction with Dr. Whorton.

On August 12, 1977, the Occupational Safety and Health Administration in a telegram alerted approximately 80 manufacturers and formulators to the potential hazard of worker exposure to DBCP. On August 23, 1977, a guideline document detailing suggested work practices was forwarded to these same affected companies. Although Shell and Dow have temporarily suspended production of DBCP and requested the return of outstanding stocks of the substance, its use in formulating pesticides may still be occurring. Therefore this ETS is necessary to limit occupational exposure.

On August 19, 1977, the Director, NIOSH, wrote to the major manufacturers of DBCP requesting information to fully evaluate the extent of the hazard posed by exposure to DBCP.

On August 23, 1977, the Oil Chemical and Atomic Workers International Union President, A. F. Grospiron, formally requested that the Secretary of Labor take immediate steps to prevent worker exposure to DBCP. Specifically, that worker exposure be limited to one part DBCP per billion parts of air, and that a broad testing program to locate incidents of cancer and sterility among workers be established.

II. EFFECTS OF EXPOSURE TO DBCP

The possible health effects of exposure to DBCP are illustrated by the results of acute and chronic toxicity studies in several animal species and the recent shocking discovery of sterility in a large number of male employees exposed to DBCP in the manufacture and formulation of pesticides. These effects may include in addition to sterility, diminished renal function, degeneration and cirrhosis of the liver, and cancer.

A. STERILITY

Evidence in Animals. In 1961, Torkelson, et al. conducted experiments in which four animal species (male and

female rats, guinea pigs, rabbits and monkeys) were exposed to DBCP by inhalation. The test animals were subjected to 50–66 exposures of 12 ppm DBCP over 70 to 92 days. A 40 to 50 percent mortality was observed in the rat study groups which, in most cases, was attributed to lung infections. Examination at autopsy showed damage to the lungs, kidneys, digestive system, and "severe atrophy and degeneration of the testes of all species." This effect was accompanied by a reduced sperm count, abnormal sperm cell development and degeneration of the seminiferous tubules. A 1970 subacute study by Faydysh et al. showed that a 70 mg/kg/day dose of DBCP, administered orally in oil solution for 45 days, produced a necrotic action on the testicles of white rats.

A more recent report in 1971 by Rakmatullaev disclosed that chronic (8 months) exposures to 5 mg/kg/day DBCP produced a distinct decrease in sperm motility for male rats and a decrease in overall female fertility.

Additional research on DBCP by Reznik and Sprinchan (1975) specifically showed gonadotoxic effects in male and female rats. In a series of both acute (single dose of 100 mg/kg) and chronic (10 mg/kg in multiple doses for 4–5) experiments, these investigators found that DBCP not only severely affected spermatogensis, but had a profound effect on the estrous cycle of the female rats.

Evidence in humans. Concern for possible sterility effects resulting from exposure to DBCP first developed among employees of the Agricultural Chemical (Ag Chem) Division of Occidental Chemical Company in Lathrop, Calif. For several years, the lack of children being born to families of men working in the Ag Chem Plant was a topic of casual discussion among these employees. Within the last several months, there developed an increasing concern that the low birth rate among these families might be related to pesticide poisoning. Finally, at the suggestion of the employee union, the Oil, Chemical, and Atomic Workers (OCAW), seven employees from the Ag Chem Plant volunteered for sperm counts to be taken.

Early in July 1977, laboratory reports of abnormal sperm counts taken from these seven men were sent to Dr. Donald Whorton, a physician at the University of California at Berkeley, who specializes in internal medicine and occupational diseases.

On the 22nd of July, Dr. Whorton performed sperm counts on five of the seven men. Again their sperm counts showed either oligospermia (low sperm count) or aspermia (no sperm). Arrangements were made with management for Dr. Whorton to see the remaining employees who worked in the Ag Chem area or in the adjacent laboratory that did the quality control work. Twenty-six were production workers, 3 were supervisors, 4 were maintenance mechanics, 2 were clerical, and 6 were laboratory personnel. This made a total of 41 employees of which 3 were women.

The examination consisted of: (1) A complete medical history with emphasis on the reproductive tract as well as diseases and conditions that may cause sterility; (2) a work history; and (3) a thorough physical examination, including laboratory tests of a comprehensive nature.

The results of the physical exams were essentially normal, other than anticipated conditions based on medical history non-related to occupational exposure. The results of the blood analysis, kidney and renal functions, cholesterol, glucose, calcium and phosphorus determinations revealed no unexpected results.

As stated earlier, three of the 41 employees examined were women. Eleven of the 38 men had had previous vasectomies. The remaining 27 men had complete sperm analysis. A complete sperm analysis includes a sperm count (sperms per cubic millimeter of seminal fluid), sperm motility (movement), and morphology (size and shape). Of these 27 men, 14 had sperm counts less than 40 million—considered abnormally low by Dr. Whorton's criterion. None of the 14 were completely aspermic, having sperm counts of zero. Two had counts in the range of 1 million, one had a count in the range of 10 to 20 million, and two had counts in the range of 20 to 30 million. Dr. Whorton described sperm count as a relatively standard examination performed in most clinical laboratories and by a large number of urologists, primarily in evaluating male infertility.

Samples of sperm from all workers, except 4, examined by Dr. Whorton, were analyzed immediately upon collection, and the remaining ones were done within 12 hours or less. Sperm samples can be used up to 24 hours after the time they have been collected.

In all the men the testes were of normal size, and the serum testosterones of workers who had normal sperm counts were essentially normal. There was a marked difference in the FSH (follicle-stimulating hormone) levels and the LH (luteinizing hormone) levels in the eleven employees most severely affected (sperm count of 1 million or less) as compared to the 13 who had sperm counts of more than 40 million.

Studies are continuing on ten of the 41 men. These men were selected for open bilateral testicular biopsy on the basis of clinical findings and in order to learn all that could be learned of what was happening histologically to these testes. Also through a contract with NIOSH the rest of the employees in the Occidental plant are to be examined on a volunteer basis for sperm counts, FSH, LH, and serum testosterone. Examining a larger population may more clearly indicate the value of these tests in determining the adverse health effects.

Under a NIOSH contract Dr. Whorton is engaged in a medical examination of some pesticide applicators and set-up men employed by Occidental Chemical to demonstrate the proper application and use of DBCP to farmers. At present, there is only limited data regarding these men, but already Dr. Whorton has observed abnormal sperm counts in approximately five out of nine workers.

Evidence of effects similar to those observed by Dr. Whorton have been reported to OSHA by the Dow Chemical Co. and Shell Oil Co., the only two known U.S. producers of DBCP (both of these companies reported that they have recently suspended all operations involving manufacture and formulation of DBCP pesticides and have requested the return of all outstanding stocks).

In a telegram dated August 31, 1977, the Corporate Medical Director of Shell Oil Co. reported that among employees exposed to DBCP who had been examined to date, abnormally low sperm counts had been obtained based on a single specimen per employee. Seven of eleven employees from one plant had sperm counts of 40 million or less. Twenty out of twenty-seven employees in a second plant had resulting sperm counts less than 40 million. In the second plant, production of DBCP was discontinued in 1975. Shell estimates that employee exposures to DBCP have ranged from less than 100 ppb to 600 ppb for the past three years.

In a letter dated September 1, 1977, the Medical Director of Dow Chemical Co. reported that in their plant in Magnolia, Ark., DBCP production and formulation began in January 1976 and was discontinued in August 1977. To date 86 employees have been examined out of a total of approximately 150 who may have been exposed to DBCP. Among the 86 examined, aspermia has been found in 24 percent and 46 percent have oligospermia.

In summary, sterility has been consistently found in employees in several plants whose exposure to DBCP was in some cases quite brief and in most cases at levels which have generally been regarded as low. The possibility of other health effects cannot be dismissed as the examination of large numbers of exposed workers continues.

B. CARCINOGENICITY

The National Cancer Institute undertook in 1972 studies of the possible carcinogenicity of DBCP, as one of a group of halogenated compounds. As early as 14 weeks after the initiation of administration by stomach tube of daily doses of 24 mg/kg of DBCP dissolved in corn oil, 5 times per week, several female rats were found to have palpable mammary tumors. Female rats given daily doses of 12 mg/kg of DBCP had not developed mammary tumors. After the fourteenth week, the doses were increased to 30 and 15 mg/kg/day. These doses were continued up to a total duration of the experiment of 52 weeks. During this period, 7 males and 11 females of the 50 rats of each sex given each dose of DBCP used in the experiment died without tumors. Seventeen of the male rats and 33 of the females given the high dose developed squamous carcinomas of the forestomach and 12 of the females had adenocarcinomas of the breast. Five female rats given the low dose of DBCP developed mammary carcinomas and 4 males and

14 females developed gastric carcinomas. One male among the 20 rats of each sex used as vehicle controls developed a tumor that was not described more specifically. Groups of 50 male mice given 160 or 80 mg/kg/day of DBCP for 14 weeks, 200 or 100 mg/kg/day for the next 13 weeks, and 260 or 130 mg/kg/day for 25 weeks and numerically similar groups of female mice given 120 or 60 mg/kg/day for the first 14 weeks and thereafter given the same doses as the males developed 14 gastric carcinomas in males and 9 in females on the high dose, and 3 in each sex on the low dose of DBCP. No mammary carcinomas developed in the female mice and no tumors of any sort developed in the vehicle controls (20 of each sex or each species).

A report in abstract form (Powers et al., 1975) at a later stage of the same study (after 78 weeks) changed the results in a quantitative way only, the incidence of mammary adenocarcinoma in female rats increasing to 54 percent and that of squamous cell carcinoma of the stomach exceeding 60 percent in the rats and 90 percent in the mice.

A draft of the final report of the contractor (Hazleton Laboratories America, 1977) to the National Cancer Institute reveals that male B6C3F1 mice received 160 or 80 mg/kg/day of DBCP by gavage for 11 weeks, 200 or 100 mg/kg/day for 14 weeks and 260 or 130 mg/kg/day for 22 or 33 weeks, respectively. The time weighted average daily doses were 219 mg/kg for the high-dose group and 113 mg/kg for the low-dose group. The female mice of the same strain received 120 or 60 mg/kg/day during the first 11 weeks and thereafter received the same doses as the males. The time-weighted average doses for the females were 209 mg/kg and 109 mg/kg. Osborne-Mendel rats of the two sexes were given identical doses: 24 or 12 mg/kg for the first 9 weeks, 15 mg/kg for 60 weeks (males) or 64 weeks (females), followed by a 5-week observation period for the males, for the low-dose group, and 30 mg/kg for 55 weeks for the high dose group. For both male and female rats, the time-weighted average daily doses, 5 days/week, were 15 mg/kg for the low dose group and 29 mg/kg for the high dose one.

The preliminary estimates are that the growth of male mice decreased slightly after the first 8 weeks on the high dose and after 22 weeks on the low dose. The growth of the females may have decreased after 32 weeks on the high dose. Mortality among the male mice increased after 36 weeks on the high dose and after 38 weeks on the low dose; that among the females increased after 36 weeks on the high dose and after 43 weeks on the low dose. The incidences of gastric cancer in male mice were 93.5 percent on the low dose and 97.9 percent on the high dose. No other tumors were reported in the mice but toxic nephropathy was found in 23.8 percent and 93.8 percent of male mice on the low and high doses, respectively.

The similar preliminary estimates for rats are that the growth of the females decreased slightly after 9 weeks on either the low or the high dose. Mortality among the male rats increased after 47 weeks on the high dose and after 60 weeks on the low dose; that among female rats increased after 28 weeks on the high dose and after 31 weeks on the low dose. The incidences of gastric cancer were 76 percent on the low dose and 59 percent on the high dose. In the females, adenocarcinoma of the breast appeared in 48 percent of the rats on the low dose and 62 percent of those on the high dose. In both sexes of this species, there were appreciable occurrences of other malignant and benign tumors (50 percent and 18 percent in males on the low and high doses, respectively, and 14 percent and 20 percent in the females on the low and high doses). The most common of these tumors were hemangiomas and hemangiosarcomas.

Among the control rats, mammary carcinoma occurred in 10% of the female colony controls and in none of the vehicle controls. Hemangiomas or hemangiosarcomas occurred in about 5.3 percent of male colony control rats and 15 percent of the females; they appeared in 5.0 percent of female vehicle control rats and in none of the male ones. Cancer of the forestomach was found in no control rats or mice.

Ward and Habermann (1974), reported that the squamous cell carcinomas of the forestomach induced in mice and rats by gavage of DBCP directly into the stomach invaded the wall of the stomach and metastasized to peritoneal surfaces, especially in rats. The metastatic tumors frequently were associated with peritonitis and abcesses.

An increased risk for cancer has not been seen with inhalation studies in rats, however OSHA believes these results must be viewed as inconclusive due to the relatively brief duration of the studies.

There are indications from in vitro experiments that DBCP may cause mutagenic effects. Rosenkranz (1975) examined the effects of DBCP on two strains of *E. coli* and on two of the tester strains of *Salmonella typhimurium:* TA 1530 and TA 1538. DBCP was mutagenic for the first of these tester strains but not for the second, indicating that it induces mutations of the base-substitution but not of the frame-shift type. While these results are not conclusive in themselves they are not inconsistent with the animal carcinogenicity data. In general, a high correlation has been found between the results of in vitro mutagenicity tests and long term animal carcinogenicity studies.

In view of the demonstration of carcinogenicity in two mammalian species, both sexes, at multiple dose levels, in well-designed studies, OSHA believes it is necessary, as a prudent policy matter, to treat DBCP as posing a potential carcinogenic risk to workers.

C. OTHER TOXIC EFFECTS

While sterility and a potential carcinogenic risk appear to be the most important health effects associatd ewith exposure to DBCP, animal studies and human experience have revealed a variety of other acute and chronic toxic effects of skin contact (percutaneous absorption), inhalation, and ingestion. Exposure to DBCP results in irritation of the eyes and respiratory passages. The central nervous system is depressed causing apathy, sluggishness and atoxia.

The skin is slightly irritated upon short exposure. Repeated exposure causes necrosis of the dermis. Toxic amounts can be absorbed through the skin. Excessive exposure to the vapors results in damage to the liver, kidneys and various tissues including dermic, bronchioles, renal collecting tubules, lens and cornea and alimentary canal. Injury caused by DBCP is particularly slow in healing.

These aspects of DBCP toxicity further indicate the necessity of limiting employee exposure by any route of entry.

III. REASONS FOR ISSUANCE OF AN EMERGENCY TEMPORARY STANDARD

The Assistant Secretary finds that exposure to DBCP poses a grave danger to humans. Specifically, human exposure to DBCP can cause oligospermia and aspermia—commonly known as sterility. Moreover, accumulated animal studies of good design have established that DBCP is clearly a carcinogen in animals, and must therefore be viewed as posing a risk of cancer to humans.

The data on sterility in workers involved in the manufacture and formulation of DBCP have only recently been collected. In fact, investigations into this ominous loss of reproductive capacity in these men are continuing. However, current data conclusively and reliably show that the deleterious effect on the testes is significant even at extremely low levels of exposure to DBCP. The preliminary investigations, which principally involve testing for sperm counts, have been interpreted by OSHA to conclusively establish that DBCP causes sterility. This evidence of a new hazard to employees is further substantiated by earlier evidence that DBCP causes sterility in animals, even though the dosages were higher. The Assistant Secretary, in light of this new and convincing evidence, concludes that occupational exposure to DBCP causes sterility.

In addition, recent animal studies have demonstrated the carcinogenicity of DBCP. Olsen, et al. in 1973, Powers, et al. in 1975, and Weisburger, et al. in 1977, have produced squamous cell carcinomas of the stomach in a high percentage of the exposed population of animals. In light of this recent evidence and the overwhelming scientific support for the view that substances shown to cause cancer in animals must be treated as posing a carcinogenic risk to man, the Assistant Secretary must treat DBCP as posing a cancer risk in humans, especially since it has been shown to have detrimental biological effect in man. The best available scientific evidence indicates that no safe level for exposure to a carcinogen, including DBCP, can be established at present. OSHA has considered this question of a safe level in previous rulemaking proceedings (see preambles to carcinogen standards (39 FR 3758), vinyl chloride standard (39 FR 35892), and

coke oven emissions standard (41 FR 46742)) and has concluded that, as a prudent policy matter, in the absence of a demonstrated safe level or threshold for a particular carcinogen, it must be assumed that none exists. This view is consistent with a considerable body of scientific opinion holding that when dealing with a carcinogen, no safe level can be determined for any given population. For example, the National Cancer Institute's Ad Hoc Committee on the Evaluation of Low Levels of Environmental Chemical Carcinogens (1970) states:

> No level of exposure to a chemical carcinogen should be considered toxicologically insignificant for man. For carcinogenic agents, a "safe level for man" cannot be established by application of our present knowledge. (NCI, 1970, p. 1.)

And NIOSH has taken the position that in regulating cancer-causing substances "* * * it is not possible at present to determine a safe exposure level for carcinogens." (Rev. Arsenic Crit. Doc. 1975.)

In conclusion, the Assistant Secretary determines that exposure of employees to a known sterility-inducing and cancer-causing substance in the workplace environment is a "grave danger" within the meaning of section 6(c)(1)(A) of the Act.

That cancer and substances which cause cancer pose a grave danger within the meaning of section 6(c)(1)(A) needs little supportive discussion. The nature of the cancer hazard differs from many other types of toxicity. Employees exposed to carcinogens risk incurable, irreversible and even fatal consequences. No symptomatic evidence of the development of the cancer may be apparent to the employee during a long latency period of 10–30 years. A single exposure episode may be sufficient to cause cancer. These factors, which establish the grave danger posed by exposure to carcinogens, also lead inexorably to the conclusion that it is necessary to provide immediate protection for employees through the issuance of an emergency temporary standard, within the meaning of section 6(c)(1)(B) of the Act.

Substances which cause involuntary sterility must also be viewed as posing a grave danger within the meaning of section 6(c)(1)(A) of the Act. Sterility in man, while perhaps not physically painful, nor equivalent to the loss of life itself, is a serious impairment of a vital and necessary bodily function—the ability to reproduce. Furthermore, sterility can have devastating psychological effects.

The need for immediate regulation to limit exposure to DBCP is apparent from the above discussion. Both as a carcinogen and as a quick-acting sterilant (some employees who became sterile had been exposed for only a few months), DBCP can pose its life-threatening danger in a very brief period of exposure. Without this emergency temporary standard, employees would continue to be exposed to this threat during the period of time necessary to complete the normal rulemaking process. Issuance of this ETS is therefore necessary to protect employees from this grave danger.

IV. Summary and Explanation of the Standard

The requirements of the emergency temporary standard are those which OSHA considers essential and feasible to protect employees from the grave danger resulting from DBCP exposure until a permanent standard can be promulgated in accordance with sections 6(b) and (c) of the Act. The following section discusses the significant provisions of the emergency temporary standard for DBCP and the necessity for including these provisions in the ETS.

1. Paragraph (a).—*Scope and application.* This standard applies to all employment where DBCP is present with the limited exception provided below. The principal activities covered by this ETS include the manufacture of DBCP, the formulation of pesticides containing DBCP, and related activities of packaging, repackaging, storage, transportation, and disposal of DBCP.

This standard does not apply to exposures which result solely from the application and use of DBCP as a pesticide. The clinical evidence of sterility has been observed principally among employees engaged in manufacture of DBCP and formulation of pesticides containing DBCP. However, among the employees of Oxidental Chemical Co., examined by Dr. Whorton were nine demonstrator applicators and "set-up" men. Five of the nine were found to have abnormally low sperm counts. Few examinations have been performed to date among the workers whose only exposure to DBCP has resulted from its typical use as a pesticide in agricultural operations. Nevertheless, OSHA believes that the human health effects actually observed among workers exposed to relatively low levels of DBCP combined with the related findings of reproductive effects and carcinogenicity in several animal studies strongly indicate that similar hazards are to be expected among those workers exposed to DBCP in the agricultural pesticide applications. At the same time, OSHA recognizes the important role that EPA regulation of pesticides has for the protection of those workers engaged in the application and use of DBCP. In issuing this ETS, OSHA is acting to assure immediate protection of workers whose exposure to DBCP is not presently covered by a specific regulation of either agency, i.e. those engaged in manufacturing and formulation operations. EPA has indicated that it intends to respond immediately to appropriately limit the use of DBCP-containing pesticides based on the recent new evidence. In view of the possibility that immediate EPA action in this case could remove the need for further action by OSHA to protect these employees, this ETS does not now apply to the application of DBCP pesticides or to subsequent exposure of field employees. OSHA will consider including these operations and employees in the permanent standard for DBCP and possibly amending this ETS to cover these operations and employees as information concerning adverse effects on these employees and possible parallel EPA action develops.

2. Paragraph (c).—*Permissible exposure limits.* The ETS establishes a permissible airborne exposure limit and a prohibition on eye or skin contact with DBCP. The eight-hour time-weighted average is set at 10 parts DBCP per billion parts of air (10 ppb); or 0.097 milligrams DBCP per cubic meter of air (0.097 mg/cu. m.) where exposure is to dusts or mists, or dusts and/or mists combined with vapor. A ceiling permissible exposure limit is established at 50 ppb (0.48 mg/cu. m.), as averaged over any 15 minutes.

The reported exposure of employees at concentrations significantly less than 1 ppm at several manufacturing and formulating plants and the resulting sterility effect in a substantial proportion of the exposed employees even at that level clearly indicates that a substantial reduction must be accomplished to mitigate the risk. There is, unfortunately, no accurate information on the exact level necessary to eliminate this risk. Here, we cannot determine the exact mechanism and cannot determine whether there is a safe level or threshold level below which reproductive effects would not occur.

In addition, while DBCP has not yet been demonstrated to be a carcinogen in humans, the clear evidence from several animal tests in mammalian species indicates that for the protection of the worker, we must regard DBCP as posing a potential carcinogen risk. OSHA policy, which is based on the best available scientific evidence and which is consistent with the policies and recommendations of nearly all public bodies which have addressed the problem of exposure to cancer-causing substances, has been and is that a substance which causes cancer in animals must be regulated as a human carcinogen and in the absence of a demonstrated "safe" or "no effect" level for human exposure to a carcinogen, it must be assumed, as a prudent policy matter, that no safe level exists.

Accordingly, the setting of an exposure level for DBCP cannot be based on a determination of a "safe" level which will eliminate the cancer and sterility hazard, but rather on a determination of a level which will immediately minimize the hazard to the greatest extent possible, within the confines of feasibility. Consequently it is determined that a prudent assessment of both the health effects, and the measurement technology, and the means for reducing employee exposure directs the establishment of an eight-hour time weighted average permissible exposure limit of 10 ppb.

In addition to limiting the 8-hour time weighted average exposures to 10 ppb, the emergency standard requires that no employee be exposed to DBCP in excess of 50 ppb averaged over any 15-minute period. An employee may be exposed to

varying concentrations of DBCP during the course of the work day with some periods of exposure above 10 ppb and corresponding periods below 10 ppb. OSHA believes that the uncertainty regarding the concentrations and duration of exposure that may cause sterility or increase carcinogenic risk requires that the magnitude of brief excursions must be limited. Consequently, a ceiling limit of 50 ppb averaged over any 15 minute period is established.

3. Paragraph (d).—*Notification of use.* The ETS requires employers to notify the OSHA Area Director of the location of workplaces where DBCP is present, and to describe the conditions of use and exposure and the protective measures in effect. This will permit OSHA to assemble a better profile of the industry, its capabilities, and the affected workforce and to more effectively schedule and conduct its enforcement activities.

4. Paragraph (e).—*Exposure monitoring.* The exposure monitoring provisions intend that the employer determine the exposure for each employee exposed to DBCP. This does not require separate measurements for each employee. If a number of employees perform essentially the same job under the same conditions, it may be sufficient to monitor a significant fraction of such employees and obtain results that are representative of the remaining employees.

Where exposures are determined to be above the permissible exposure limit, the employer must monitor monthly. Otherwise the employer may monitor quarterly. "Exposure" in this connection means the airborne concentrations in the worker's breathing zone, with no adjustment for the protection of any respirator the employee may be wearing.

The employer is also required to monitor again if any changes in production, processes, control measures or personnel make it likely that new or additional exposures to DBCP will result.

5. Paragraph (f).—*Methods of compliance.* The standard is flexible and permits a variety of responses to achieve the required reduction in employee exposure. The employer may use feasible engineering controls, work practices, personal protective equipment and respirators as necessary to achieve the required degree of protection. This is substantively different from the requirement in existing OSHA permanent standards. In these there is a hierarchy, requiring maximal use of engineering controls, and work practices, and allowing respirators and personal protection only where all other feasible means fail to control exposure.

Some fundamental and easily implemented work practices are prescribed specifically in the standard; limiting access to work areas to only necessary employees; prohibiting smoking and eating in work areas, and housekeeping and maintenance to reduce amounts of material that may be present in the workplace.

The ETS also requires employers to prepare a plan to reduce employee exposure to the lowest feasible level solely by engineering and work practice methods, within 90 days of the issuance of the ETS. While the ETS will be in effect for only a brief time, and a full public proceeding must precede the issuance of a permanent standard, OSHA believes it is necessary to begin planning now for employee protection in the long term. Because of the general irreversibility of cancer as pointed out above, OSHA considers the early reduction of employee exposures the most significant provision in decreasing the gravity of the health risk.

6. Paragraph (g).—*Respiratory protection.* The ETS provides that, whenever the permissible exposure limits are exceeded, the employer must provide and assure that the employees use respirators. The ETS contains a respirator selection table (table 1) so the employer will provide the type of respirator which affords the proper degree of protection based on the airborne concentrations of DBCP to which the employee may be exposed. The respirator table for DBCP is derived from the Standards Completion Project respirator decision logic.

Because of the lead time in obtaining atmosphere supplying respirators, the ETS permits the use of air-purifying respirators (pesticide type, using a chemical cartridge with particulate filter), in spite of the fact that DBCP has no useful warning properties at concentrations where the protection factor of negative-mode respirators may be used.

Because DBCP has no warning properties at concentrations where the use of air-purifying respirators is permitted, and because these respirators have no end-of-service life, the ETS requires that the cartridges or cannister be replaced at the end of each work shift in which they are first used. Special care must be taken in their use to assure proper fitting.

The ETS requires that the employee be properly trained to wear the respirator, to know why the respirator is needed and to understand the limitations of the respirator. An understanding of the hazards involved is necessary to enable the employee to take steps for his or her own protection. The respiratory protection program implemented by the employer must conform with 29 CFR 1910.134. This section contains the basic requirements for use, cleaning, and maintenance of respirators.

To prevent skin irritation and to minimize the discomfort of respirator use, the ETS requires that employees must be allowed to periodically wash their faces and respirator facepieces in order to remove any accumulation of the DBCP or to reduce the chance of irritation from the wearing of the facepiece itself, such as a heat rash.

7. Paragraph (h).—*Protective clothing and equipment.* The ETS requires the employer to provide and assure that employees, who are subject to skin or any eye contact, use impermeable protective clothing or equipment such as goggles in order to minimize these hazards.

The ETS also requires that the employer clean, launder, or dispose of the required protective clothing to eliminate any potential exposure that might result were the clothing to be laundered by the employee, at home or in a commercial laundry.

The ETS also requires that protective clothing be provided in a clean and dry condition daily. Since skin contact with DBCP creates a potential for skin absorption, OSHA believes that the regular cleaning of contaminated work clothing plays an important role in the prevention of this hazard. The ETS also requires that protective clothing and equipment be maintained and replaced as needed in order to ensure effectiveness.

The ETS provides that the employer assure that all protective clothing is removed at the end of each work shift, and that the clothing that is to be laundered, cleaned, or disposed of be placed in a closable container. The purpose in requiring such a container is to prevent the contaminants on the clothing from being released in the ambient air or from being contacted by an individual handling the container.

Finally, the ETS requires employers to inform those who handle the contaminated protective clothing of the potentially harmful effects of exposure to DBCP. This provision is designed to make clear the need to use proper care in handling of the contaminated protective clothing.

8. Paragraph (i).—*Housekeeping.* Removal and prevention of accumulations of liquid deposits of DBCP or dusts containing DBCP, on all surfaces are important aspects in minimizing employee exposure. To assure that DBCP is not reintroduced into the workplace air, the standard prohibits dry sweeping or the use of compressed air for cleaning floors and other surfaces where DBCP is found. The standard also requires that when DBCP is present in liquid form, or as a resultant vapor, that all containers or vessels be enclosed to the maximum extent feasible and tightly covered when not in use.

For disposal of waste scrap or equipment or debris containing DBCP, the standard requires that such material be collected and disposed of in sealed or closed containers which prevent the dispersion of DBCP outside the containers. State environmental protection agencies designate appropriate landfills for the disposal of such waste.

9. Paragraph (j).—*Hygiene facilities and practices.* § 1910.141 prescribes hygiene facilities and practices required in all workplaces for ordinary sanitary protection. In addition, it includes provisions applicable where toxic substances are handled, for appropriate facilities and practices. While § 1910.141 is a separately applicable provision in OSHA regulations, attention is directed to it by specifically referring to it in this ETS.

10. Paragraph (k).—*Medical surveillance.* The standard requires that each employer institute a medical surveillance program for all employees who are, or

will be exposed to DBCP. OSHA believes that a medical surveillance program is necessary in dealing with the problem of employee exposure to DBCP; hence, pursuant to the Act, this standard has prescribed it. The authority, indeed the requirement, to include medical surveillance in an OSHA standard is found in 6(b)(7) of the Act:

> * * * where appropriate, any such standard promulgated under subsection 6(b) shall prescribe the type and frequency of medical examinations or other tests which shall be made available, by the employer or at his cost, to employees exposed to such employment related hazards in order to most effectively determine whether the health of such employees is adversely affected by such exposure.

The ETS requires that the medical surveillance program provide each covered employee with an opportunity for medical examination.

All examinations and procedures are required to be performed by or under the supervision of a licensed physician and provided without cost to the employee. While the physician will usually be selected by the employer, the standard does not so mandate, leaving the employer free to institute alternative procedures such as joint selection with the employee or selection by the employee. Clearly, a licensed physician is the appropriate person to be conducting a medical examination. However, certain parts of the required examination (e.g. taking of a history) do not necessarily require a physician's expertise and may be conducted by another person under the supervision of the physician. As noted above, the Congress has mandated, by reason of section 6(b)(7) of the Act, that medical examinations and procedures required by OSHA standards be provided at no cost to the employee.

The ETS provides that a work history, medical history, and medical examination be performed. The content of the examination is consistent with that which has been employed by Dr. Whorton and physicians at Dow and Shell in the clinical evaluation of employees exposed to DBCP and which OSHA therefore believes is appropriate for this ETS. The purpose of this requirement is to make an initial medical assessment of each employee and to establish a baseline health condition against which future changes in an employee's health may be compared.

The standard requires that the employer provide the physician with certain information. This includes: (1) A copy of the regulation; (2) a description of the affected employee's duties as they relate to the employee's exposure; (3) the results of the employee's exposure monitoring; (4) if any personal protective equipment is used or is to be used; and (5) information from previous medical examinations of the affected employee to the extent that they are not readily available to the physician. The purpose of making this information available to the physician is to aid in the evaluation of the employee's health in relation to his assigned duties and fitness to wear personal protective equipment when required.

The employer is required to obtain a written opinion from the examining physician containing: (1) The results of the medical tests; (2) the physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of health from exposure to DBCP; (3) any recommended limitations upon the employee's exposure to DBCP and upon the use of protective clothing and equipment such as respirators; and (4) a statement that the employee has been informed by the physician in writing of the test results, and of any medical conditions which require further examination or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to occupational exposure. A copy of the opinion must be provided to the affected employee by the employer.

The requirement that the employee be provided with a copy of the physician's written opinion will assure that the employee is informed of the results of the medical examination and may take any appropriate action. The purpose in requiring that specific findings or diagnoses unrelated to occupational exposure not be included in the written opinion is to encourage employees to submit to medical examination by removing the fear that employers may find out information about their physical condition that has no relation to occupational exposures.

11. Paragraph (l).—*Employee information and training.* The ETS requires the employer to provide a training program for employees exposed to DBCP. OSHA believes that an information and training program is essential for the protection of employees, because an employee can do much to protect himself if informed of the nature of the hazards in the workplace. To be effective, an employee education system must, at the minimum, apprise the employee of the specific hazards associated with his work environment. For this reason, the employer is required to inform each employee exposed to the DBCP of the nature of the related health problems; the necessity for exposure control and the medical and industrial hygiene monitoring programs.

The content of the training program is intended to apprise the employees of: (1) The hazards to which they are exposed; (2) the necessary steps to protect themselves, including avoiding exposures, using respiratory protection and taking medical examinations; (3) their role in reducing exposures; and (4) the contents of the standard. Section 6(b)(7) of the Act makes it clear that these are appropriate goals of an employee training program, and the standard, therefore, includes them.

The employer is also required to provide, upon request, all materials relating to the training program to the Secretary and the Director. This is intended to provide an objective check of compliance with the requirements of the standard.

12. Paragraph (m).—*Signs and labels.* OSHA believes that it is important, and indeed section 6(b)(7) of the Act provides, that appropriate forms of warning, as necessary, be used to apprise employees of the hazards to which they are exposed in the course of their employment. OSHA believes, as a matter of policy, that employees should be given the opportunity to make informed decisions as whether to work at a job under the particular working conditions. Furthermore, OSHA believes that since control of safety and health problems involves the cooperation of employees, success of a program is highly dependent upon the employee's understanding of the hazards attendant to that job.

In light of the serious nature of the hazard of exposure to DBCP, OSHA does not believe that periodic training alone will adequately apprise employees of the health hazards of DBCP. However, coupled with the training requirements, OSHA believes that the requirement to post signs and labels will adequately do so.

The standard requires that no statement which contradicts or detracts from the effect of any sign required by this paragraph shall appear on or near any such required sign.

Due to the hazardous nature of exposure to DBCP, OSHA believes that emphasis should be placed on warning employees and other persons about the danger of exposure. For this reason, the standard includes a requirement that caution labels be affixed to all containers containing DBCP and of the products containing it, not only because of the hazardous nature of such exposure, but because of the related necessity for both the employer and employee to know whether the product contains any DBCP. The labeling provisions for the standard also require the employer to assure that caution labels are affixed to any product containing the DBCP when such product leaves the employer's workplace. This requirement is designed to protect any other employees who will be handling, transporting, or using this product. Thus manufacturers and suppliers would be required to affix caution labels. The rationale for this requirement is that the manufacturer or supplier is the employer creating the hazard and is in the best position to know whether the product does contain DBCP and therefore to warn other employers and their employees. However, where DBCP or products containing DBCP are sold, distributed or otherwise leave the employer's workplace bearing appropriate labels required by EPA under the regulations in 40 CFR Part 162, the labels required by this paragraph need not be affixed.

13. Paragraph (n).—*Recordkeeping.* Section 8(c)(3) of the Act provides for the promulgation of regulations requiring employers to maintain accurate records of employee exposures to potentially toxic or harmful physical agents which are required to be monitored or measured.

The standard provides that records must be kept to identify the employee and to accurately reflect the employee's exposure. Specifically, it must include: (a) The names, social security numbers; and job classification of the employees monitored; (b) the dates, number, duration, and results of each of the samples taken, including a description of the representative sampling procedure used to determine employee exposure where applicable; (c) the type of respiratory protective devices worn by the employee, if any; and (d) a description of the sampling and analytical methods used, and evidence of their accuracy.

The ETS also requires that the employer keep an accurate medical record for each employee who is subject to medical surveillance. Section 8(c) of the Act authorizes the promulgation of regulations requiring any employer to keep such records regarding the employer's activities relating to the Act as are necessary or appropriate for the enforcement of the Act or for developing information regarding the causes and prevention of occupational illnesses. OSHA believes that medical records (like exposure monitoring records) are both necessary and appropriate to both the enforcement of the standards and the development of information regarding the causes and prevention of illness.

As explained above, it is necessary to relate employees' medical conditions with their exposures in order to develop information regarding cause and prevention. Medical records are necessary and appropriate for this purpose. In addition, medical records are necessary for the proper evaluation of an individual employee's health. For all of these reasons, medical records have been required in the ETS.

The ETS requires that employees or their designated representatives be provided access to examine and copy records of required monitoring. The purpose of this provision is to assure current employees that their exposure is being properly monitored and that they are working in a safe and healthful environment. Section 8(c)(3) of the Act explicitly provides "employees or their representatives with an opportunity to observe * * * monitoring or measuring * * * and to have access to the records thereof."

The ETS requires that employee medical records be made available upon request for examination and copying to the affected employee or former employee or to a physician designated by the affected employee or former employee. The purpose of this provision is to protect the employee's health by authorizing his designated physician to have access to medical records useful in the diagnosis of illness.

14. Paragraph (o).—*Observation of monitoring.* Section 8(c)(3) of the Act requires that employers provide employees or their representatives with the opportunity to observe monitoring of employee exposures to toxic substances or harmful physical agents. In accordance with this section, the ETS contains provisions for such observation of DBCP monitoring. To assure that the right to observe is meaningful, observers are entitled to receive an explanation of the measurement procedure, to observe all steps related to the measurement procedure and record the results obtained.

The observer, whether an employee or designated representative, must be provided with, and is required to use, any personal protective devices required to be worn by employees working in the area that is being monitored, and must comply with all other applicable safety and health procedures.

15. Paragraph (p).—*Effective date.* The ETS becomes effective upon publication. However, certain paragraphs do contain briefly delayed effective dates.

The Assistant Secretary determines that all requirements under the new § 1910.1044 are feasible. Since the number of affected employers and employees is relatively small and since the required personal protective equipment, respirators, and monitoring equipment is standard, all necessary equipment is readily available in sufficient quantities. Where additional time for compliance is needed under certain provisions of the standard, such time has been explicitly granted. Examples of this are the medical surveillance and the training sections. Furthermore, many of the requirements of the new standard are already required by other OSHA standards, such as the eye and face protection under § 1910.133, respiratory protection under § 1910.134, and sanitation under § 1910.141. Finally, any feasibility problems concerning the immediate effective date are mitigated by: (1) The fact that, for years, EPA has required the use of labels warning of the hazardous nature of DBCP; (2) the fact that emergency information was sent by OSHA to all producers and formulators of DBCP warning of its hazardous properties; and (3) the fact that the two domestic producers have suspended production and have requested the return of all outstanding inventories of DBCP. Accordingly, employers for a substantial period of time, have been apprised of the hazardous nature of DBCP and of the need to provide protection, including the need for respirators and other protective equipment. Moreover, the number of employees exposed to DBCP should decrease as a result of the suspended productions.

16. Paragraph (q).—*Appendices.* The ETS includes three appendices: Appendix A titled "Substance Safety Data Sheet," Appendix B titled "Substance Technical Guidelines," and Appendix C titled "Medical Surveillance Guidelines." It should be noted that appendices are for informational purposes only. None of the statements contained therein should be construed as imposing a mandatory requirement not in the ETS, negating any requirement which is imposed by the standard.

The information in Appendix A is specifically written for the employee. Appendix B contains additional scientific and technical information to aid the employer in complying with requirements of the standard. Appendix C gives the employer a means of providing the examining physician with an explanation of the potential health effects of exposure to DBCP and provides information needed by the physician to evaluate the results of the medical examination. Appendix C also lists other types of examinations, not required by the individual standard, which may help the physician in making an accurate determination of whether an employee should be exposed or should continue to be exposed to DBCP.

17. References

The studies and other data listed below, as well as the additional material referred to in this document, represent the principal sources upon which the Emergency Temporary Standard is based. A complete set of the references is available for examination and copying at the OSHA Technical Data Center, Docket Office, Room S6212, U.S. Department of Labor, Second Street and Constitution Avenue NW., Washington, D.C. between 8:30 a.m. and 4:30 p.m. Monday through Friday, legal holidays excepted.

1. Faydysh, E. V., N. N. Rakhmatullaev, and V. A. Varshavskii: The cytoxic action of Nemagon in a subacute experiment. *Med. Zh. Uzbekistana*, 1:64–5, 1970 (Russian).

2. Olsen, W. A., R. T. Habermann, E. K. Weisburger, J. M. Ward, and J. H. Weisburger: Induction of stomach cancer in rats and mice by halogenated aliphatic fumigants. *Journal of the National Cancer Institute*, 51(6):1993–1995, 1973.

3. Powers, M. B., R. W. Voelker, N. P. Page, E. K. Weisburger, and H. F. Kraybill: Carcinogenicity of Ethylene Dibromide (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) after oral administration in rats and mice.

4. Rakhmatullaev, N. N.: Hygienic characteristics of the nematocide Nemagon in relation to water pollution control. *Hyg. Sanit.*, 36(3):344–348, 1971 (Russian).

5. Reznik, Ya. B., and G. K. Sprinchan: Experimental data on the gonadotoxic effect of Nemagon. *Gig. Sanit.*, 6:101–102, 1975 (Russian).

6. Torkelson, T. R., S. E. Sadek, V. K. Rowe, J. K. Kodama, H. H. Anderson, G. S. Loquvam, and C. H. Hine: Toxicologic investigations of 1,2-Dibromo-3-chloropropane. *Toxicology and Applied Pharmacology*, 3:545–559, 1961.

7. Weisburger, E. K.: Carcinogenicity studies on halogenated hydrocarbons. *Environmental Health Perspectives*, In press.

8. Whorton, Donald, M.D. OSHA interview with Dr. Whorton on August 31, 1977, concerning the sterility of workers exposed to 1,2-Dibromo-3-chloropropane at Occidental Chemical Co.'s Lathrop, Calif., plant.

9. Telegram, Dr. Eula Bingham, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, Washington, D.C., to Dr. V. K. Rowe, Dow Chemical U.S.A., 1803 Building, Midland, Mich., requesting information on employee exposure to 1,2-Dibromo-3-chloropropane and Ethylene dibromide; dated August 30, 1977.

10. Letter from Dow Chemical U.S.A., Dr. Benjamin B. Holder responding for Dr. Rowe to Dr. Eula Bingham, Assistant Secretary for Occupational Safety and Health, U.S. Department of Labor, dated September 1, 1977.

11. Telegram, Dr. Eula Bingham, Assistant Secretary of Labor for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Department of Labor, Washington, D.C., to Dr. R. E. Joyner, Corporate Medical Director, Shell Oil Co., P.O. Box 2463, Houston, Tex. 77001, requesting

information on employee exposure to 1,2-Dibromo-3-chloropropane, and Ethylene dibromide; dated August 30, 1977.

12. Telegram from Shell Oil Co., Dr. R. E. Joyner, M.D., Corporate Medical Director to Dr. Eula Bingham, Assistant Secretary for Occupational Safety and Health, U.S. Department of Labor, dated August 31, 1977.

13. Telegram, U.S. Department of Labor, Occupational Safety and Health Administration, Office of Field Coordination, to all producers and users of 1,2-Dibromo-3-chloropropane, dated August 12, 1977.

14. Letter, Occupational Health Guideline for 1,2-Dibromo-3-chloropropane (DBCP), U.S. Department of Labor, Occupational Safety and Health Administration, sent to all producers and users of DBCP, dated August 25, 1977.

15. Joint NIOSH–OSHA Standards Completion Program, Respirator Decision Logic, August 2, 1976. Occupational Safety and Health Administration, Washington, D.C. 20210.

16. Draft working document for 29 CFR Part 1990. Identification, classification, and regulation of certain toxic substances. Identification, classification, and regulation of toxic substances posing a potential occupational carcinogenic risk. Occupational Safety and Health Administration, Directorate of Health Standards, Washington, D.C. 20210 (January 1977).

V. Environmental and Economic Impacts

The National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) and regulations issued thereunder (29 CFR Part 1999) require that Federal agencies assess their proposed major actions to determine whether a significant impact on the quality of the human environment may result, and if necessary to prepare an environmental impact statement. An environmental impact statement on the regulation of occupational exposure to DBCP will be prepared and made available as required during the rulemaking proceedings under section 6(b) of the Act. Because of the emergency nature of this standard, no environmental impact statement can be prepared or is required for the emergency temporary standard.

In accordance with Executive Order 11821 (39 FR 41501, November 29, 1974) Executive Order 11949 (42 FR 1017, January 5, 1977), OMB Circular No. A–107 (January 28, 1975), and Secretary's Order No. 15–75 (40 FR 54484, November 24, 1975), and administrative instructions thereto (U.S. Department of Labor Temporary Directive No. 1, November 17, 1975), OSHA has assessed the potential economic impact of this proposal. Based on the economic identification criteria specified in section 5(c) of Secretary's Order No. 15–75, OSHA has concluded that the subject matter of this proposal is not a "major" action which would necessitate further economic impact evaluation or the preparation of an Economic Impact Statement, and so certifies pursuant to section 4(a) of the Secretary's Order.

Issues concerning cost and economic impact, however, will be appropriate issues for consideration at the rulemaking proceeding.

VI. Public Participation—Notice of Hearing

Pursuant to section 6(c)(3) of the Act, this ETS as published also serves as a proposal for a permanent rule. It is OSHA's intention to develop and publish a more comprehensive proposal in the very near future. This proposal will contain additional provisions and some modifications of this emergency standard. Since the comprehensive proposal will be based on the emergency standard and since the emergency nature of the proceeding and requirements of section 6(c) will necessitate expedited treatment throughout the development of the final standard on DBCP, interested parties should begin preparation of their written comments and oral presentations immediately.

Interested persons are invited to submit written data, views, and arguments with respect to this ETS and the supplementary proposal to be published shortly. These comments must be postmarked on or before October 10, 1977, and submitted in quadruplicate to the Docket Officer, Docket No. H–061, Room S6212, U.S. Department of Labor, 3rd Street and Constitution Avenue NW., Washington, D.C. 20210. Written submissions must clearly identify the provisions of the ETS and the proposal which are addressed and the position taken with respect to each issue.

The data, views, and arguments that are submitted will be available for public inspection and copying at the above address. All timely written submissions received will be available for public inspection and copying at the above address. All timely written submissions will be made a part of the record of this proceeding.

Pursuant to section 6(b)(3) of the Act, an opportunity to submit oral testimony concerning the issues raised by the ETS and the proposed standard, including the economic and environmental impacts, will be provided at an informal public hearing scheduled to begin at 9:30 a.m. on December 6, 1977, in the New Department of Labor Auditorium, New Department of Labor Building, 3rd Street and Constitution Avenue NW., Washington, D.C. 20210.

Notices of Intention To Appear

All persons desiring to participate at the hearing, must file in quadruplicate a notice of intention to appear, postmarked on or before November 4, 1977, addressed to Mr. Stephen Kaffee, OSHA Division of Consumer Affairs, Docket No. H–061, Room N–3635, U.S. Department of Labor, 3rd Street and Constitution Avenue NW., Washington, D.C. 20210; telephone 202–523–8024.

The notices of intention to appear, which will be available for inspection and copying at the OSHA Technical Data Center—Docket Office (Room S6212), telephone 202–523–7895, must contain the following information:

(1) The name, address, and telephone number of each person to appear;

(2) The capacity in which the person will appear:

(3) The approximate amount of time requested for the presentation;

(4) The specific issues that will be addressed;

(5) A detailed statement of the position that will be taken with respect to each issue addressed; and

(6) Whether the party intends to submit documentary evidence, and if so, a brief summary of that evidence.

Filing of Testimony and Evidence Before Hearing

Any party requesting more than 15 minutes for a presentation at the hearing, or who will submit documentary evidence, must provide in quadruplicate the complete text of his testimony including any documentary evidence to be presented at the hearing, to the OSHA Division of Consumer Affairs. This material must be received by November 21, 1977, and will be available for inspection and copying at the Technical Data Center—Docket Office. Each such submission will be reviewed in light of the amount of time requested in the notice of intention to appear. In those instances where the information contained in the submission does not justify the amount of time requested, a more appropriate amount of time will be allocated and the participant will be notified of that fact.

Any party who has not substantially complied with this requirement may be limited to a 15 minute presentation, and may be requested to return for questioning at a later time.

Conduct of Hearings

The hearing will commence at 9:30 a.m. on December 6, 1977, with resolution of any procedural matters relating to the proceeding. The hearing will be conducted in accordance with 29 CFR Part 1911. In view of the emergency nature of this rulemaking proceeding, the hearing will be conducted in as expedited a manner as possible consistent with a full development of the record and the rights of the parties.

The hearing will be presided over by an Administrative Law Judge who will have all the powers necessary or appropriate to conduct a full and fair informal hearing as provided in 29 CFR Part 1911. Following the close of the hearing or of any posthearing comment period, the presiding Administrative Law Judge will certify the record to the Assistant Secretary of Labor for Occupational Safety and Health. The proposal will be reviewed in light of all oral and written submissions received as part of the record, and a standard will be issued based on the entire record in this proceeding.

Authority

This document was prepared under the direction of Eula Bingham, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, Third Street and Constitution Avenue NW., Washington, D.C. 20210.

Accordingly, pursuant to sections 6(c) and 8(c) of the Occupational Safety and Health Act of 1970 (84 Stat. 1596, 1599, 29 U.S.C. 655, 657), the Secretary of

Labor's Order No. 8-76 (41 FR 25059), and 29 CFR Part 1911, it is hereby proposed to amend Part 1910 of Title 29, Code of Federal Regulations by adding a new § 1910.1044 as set forth below. This amendment is effective on September 9, 1977.

Signed at Washington, this third day of September 1977.

EULA BINGHAM,
Assistant Secretary of Labor.

§ 1910.1044 1,2 - dibromo - 3 - chloropropane.

(a) *Scope and application.* This section applies to all occupational exposures to 1,2-dibromo-3-chloropropane (DBCP), Chemical Abstracts Service Registry Number 96-12-8, except that this section does not apply to exposure to DBCP which results solely from the application and use of DBCP as a pesticide.

(b) *Definitions.* "Authorized person" means any person specifically authorized by the employer and whose duties require the person to be present in areas where DBCP is present; and any person entering this area as a designated representative of employees exercising an opportunity to observe employee exposure monitoring.

"DBCP" means 1,2-dibromo-3-chloropropane.

"Director" means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, or designee.

"OSHA Area Office" means the Area Office of the Occupational Safety and Health Administration having jurisdiction over the geographic area where the affected workplace is located.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

(c) *Permissible exposure limits*—(1) *Inhalation.*—(i) *Time-weighted average limit (TWA).* The employer shall assure that no employee is exposed to an airborne concentration in excess of 10 parts DBCP per billion part of air (ppb) as an 8-hour time-weighted average.

(ii) *Ceiling limit.* The employer shall assure that no employee is exposed to an airborne concentration in excess of 50 parts DBCP per billion parts of air (ppb) as averaged over any 15 minutes during the working day.

(2) *Dermal and eye exposure.* The employer shall assure that no employee is exposed to eye or skin contact with DBCP.

(d) *Notification of use.* Within ten (10) days of the effective date of this section or within ten (10) days following the introduction of DBCP into the workplace, every employer who has a workplace where DBCP is present shall report the following information to the nearest OSHA Area Office for each such workplace:

(1) The address and location of each workplace in which DBCP is present;

(2) A brief description of each process or operation which may result in employee exposure to DBCP;

(3) The number of employees engaged in each process or operation who may be exposed to DBCP and an estimate of the frequency and degree of exposure that occurs;

(4) A brief description of the employer's safety and health program as it relates to limitation of employee exposure to DBCP.

(e) *Exposure monitoring*—(1) *General.* Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to DBCP over an 8-hour period. (For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.)

(2) *Initial.* Each employer who has a place of employment in which DBCP is present shall monitor, within thirty (30) days of the effective date of this section, each workplace and work operation to accurately determine the airborne concentrations of DBCP to which employees may be exposed.

(3) *Frequency.* (i) If the monitoring required by this section reveals employee exposures to be below the permissible exposure limits, the employer shall repeat these determinations at least quarterly.

(ii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly determinations until at least two consecutive measurements, taken at least seven (7) days apart, are below the permissible exposure limit, thereafter the employer shall monitor at least quarterly.

(4) *Additional.* Whenever there has been a production process, control or personnel change which may result in any new or additional exposure to DBCP, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to DBCP, additional monitoring which complies with this paragraph (e) shall be conducted.

(5) *Employee notification.* (i) Within five (5) working days after the receipt of monitoring results, the employer shall notify each employee in writing of results which represent the employee's exposure.

(ii) Whenever the results indicate that employee exposure exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.

(6) *Accuracy of measurement.* The method of measurement shall be accurate, to a confidence level of 95 percent, to within plus or minus 25 percent for concentrations of DBCP at or above the permissible exposure limits.

(f) *Methods of compliance.* The employer shall control employee exposures to airborne concentrations of DBCP to within the permissible exposure limit, and shall protect against employee exposure to eye or skin contact with DBCP by engineering controls, work practices and personal protective equipment.

(1) *Engineering controls.* The employer shall develop and implement, as soon as possible, feasible engineering controls to reduce the airborne concentrations of DBCP to within the permissible exposure limits.

(2) *Work practices.* The employer shall examine each work area in which DBCP is present and shall institute, as soon as possible, work practices to reduce employee exposure to DBCP. The work practices shall be described in writing and shall include, among other things, the following mandatory work practices:

(i) Limiting access to work areas where DBCP is present to authorized personnel only;

(ii) Prohibiting smoking and the consumption of food and beverages in work areas where DBCP is present; and

(iii) Establishing good maintenance and housekeeping practices including the prompt cleanup of spills, repair of leaks, and the practices required in paragraph (i) of this section.

(3) *Respiratory protection.* Where engineering and work practice controls are not sufficient to reduce employee exposures to airborne concentrations of DBCP to within the permissible exposure limits, the employer shall provide at no cost to the employee, and assure that employees wear, respirators in accordance with paragraph (g) of this section.

(4) *Engineering and work practice control plan.* (i) Within ninety (90) days of the effective date of this section, the employer shall develop a written plan describing proposed means to reduce employee exposures to DBCP to the lowest feasible level solely by means of engineering and work practice controls.

(ii) Written plans required under this paragraph (f)(4) shall be submitted upon request to the Secretary and the Director, and shall be available at the worksite for examination and copying by the Secretary, the Director, and any affected employee or designated representative of employees.

(g) *Respirators.*—(1) *Required use.* The employer shall assure that respirators are used where required under this section to reduce employee exposure to within the permissible exposure limits, and in emergencies.

(2) *Respirator selection.* (i) Where respirators are used to reduce employee exposures to within the permissible exposure limit and in emergencies, the employer shall select and provide, at no cost to the employee, the appropriate respirator from Table I below and shall assure that the employee wears the respirator provided.

(ii) The employer shall select respirators from among those approved by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

TABLE 1—RESPIRATORY PROTECTION FOR DBCP

Concentration not greater than:	RESPIRATORY PROTECTION
100 ppb:	Any chemical cartridge respirator with pesticide cartridge(s).
	Any supplied-air respirator.
	Any self-contained cartridge breathing apparatus.
500 ppb:	A chemical cartridge respirator with full facepiece and pesticide cartridge(s).
	A gas mask with full facepiece and pesticide canister.
	Any supplied-air respirator with full facepiece, helmet or hood.
	Any self-contained breathing apparatus with full facepiece.
5,000 ppb:	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous flow mode.
20,000 ppb:	A Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode, or with full facepiece, hood or helmet operated in continuous flow mode.
Greater than 20,000 ppb or entry and escape from unknown concentrations:	A combination respirator which includes a Type C supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure or continuous flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or positive pressure mode.
	A self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode.
Firefighting:	A self-contained breathing apparatus with full facepiece operated in pressure-demand or other positive pressure mode.

(3) *Respirator program.* (i) The employer shall institute a respiratory protection program in accordance with 29 CFR 1910.134(b), (d), (e), and (f).

(ii) Where air-purifying respirators (chemical cartridge or gas mask) are used, the air-purifying canister or cartridge(s) shall be replaced prior to the expiration of their service life or the beginning of each shift, whichever occurs first.

(iii) Employees who wear respirators shall be allowed to wash their face and respirator facepiece to prevent potential skin irritation associated with respirator use.

(h) *Protective clothing and equipment.*—(1) *Provision and use.* Where eye or skin contact with liquid or solid DBCP may occur, employers shall provide at no cost to the employee, and assure that employees wear impermeable protective clothing and equipment in accordance with §§ 1910.132 and 1910.133 to protect the area of the body which may come in contact with DBCP.

(2) *Cleaning and replacement.* (i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this paragraph to maintain their effectiveness. In addition, the employer shall provide clean protective clothing and equipment at least daily to each affected employee.

(ii) The employer shall assure that the employee removes all protective clothing and equipment at the completion of a workshift.

(iii) The employer shall assure that DBCP-contaminated protective work clothing and equipment is placed and stored in closed containers which prevent dispersion of DBCP outside the container.

(iv) The employer shall inform any person who launders or cleans DBCP-contaminated protective clothing or equipment of the potentially harmful effects of exposure to DBCP.

(v) The employer shall assure that the containers of contaminated protective clothing and equipment which are to be removed from the workplace for any reason are labeled in accordance with paragraph (m)(3) of this section.

(vi) The employer shall prohibit the removal of DBCP from protective clothing and equipment by blowing or shaking.

(i) *Housekeeping.*—(1) *Surfaces.* (i) All surfaces shall be maintained free of accumulations of DBCP.

(ii) Dry sweeping and the use of air for the cleaning of floors and other surfaces where DBCP dust or liquids are found is prohibited.

(iii) Where vacuuming methods are selected, either portable units or a permanent system may be used.

(*a*) If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filters or other appropriate means of contaminant removal, so that DBCP is not reintroduced into the workplace air; and

(*b*) Portable vacuum units used to collect DBCP may not be used for other cleaning purposes and shall be labeled as prescribed by paragraph (m)(3) of this section.

(iv) Cleaning of floors and other contaminated surfaces may not be performed by washing down with a hose, unless a fine spray has first been laid down.

(2) *Liquids.* Where DBCP is present in a liquid form, or as a resultant vapor, all containers or vessels containing DBCP shall be enclosed to the maximum extent feasible and tightly covered when not in use.

(3) *Waste disposal.* DBCP waste, scrap, debris, bags, containers or equipment, shall be disposed in sealed bags or other closed containers which prevent dispersion of DBCP outside the container.

(j) *Hygiene facilities and practices.* Hygiene facilities shall be provided and practices implemented in accordance with the requirements of § 1910.141.

(k) *Medical surveillance.*—(1) *General.* The employer shall institute a program of medical surveillance for each employee who is or will be exposed, without regard to the use of respirators, to DBCP. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this paragraph. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

(2) *Frequency and content.* Within 30 days of the effective date of this section or time of initial assignment, and whenever exposure to DBCP, the employer shall provide a medical examination including at least the following:

(i) A complete medical and occupational history with emphasis on reproductive history.

(ii) A complete physical examination with emphasis on the genito-urinary tract, testicle size, and body habitus including the following tests:

(*a*) Sperm count;

(*b*) Complete urinalysis (U/A);

(*c*) Complete blood count; and

(*d*) Thyroid profile.

(iii) A serum specimen shall be obtained and the following determinations made:

(*a*) Serum multiphasic analysis (SMA 12);

(*b*) Serum testosterone;

(*c*) Serum follicle stimulating hormone (FSH);

(*d*) Serum luteinizing hormone (LH).

(3) *Information provided to the physician.* The employer shall provide the following information to the examining physician:

(i) A copy of this emergency temporary standard and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The level of DBCP to which the employee is exposed; and

(iv) A description of any personal protective equipment used or to be used.

(4) *Physician's written opinion.* (i) The employer shall obtain a written opinion from the examining physician which shall include:

(*a*) The results of the medical tests performed;

(*b*) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of health from exposure to DBCP;

(*c*) Any recommended limitations upon the employee's exposure to DBCP or upon the use of protective clothing and equipment such as respirators; and

(*d*) A statement that the employee was informed by the physician of the results of the medical examination, and any medical conditions which require further examination or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to DBCP.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(l) *Employee information and training.*—(1) *Training Program.* (i) Within thirty (30) days of the effective date of this standard, the employer shall insti-

tute a training program for all employees who may be exposed to DBCP and shall assure their participation in such training program.

(ii) The employer shall assure that each employee is informed of the following:

(*a*) The information contained in Appendixes A, B, and C;

(*b*) The quantity, location, manner of use, release or storage of DBCP and the specific nature of operations which could result in exposure to DBCP as well as any necessary protective steps;

(*c*) The purpose, proper use, and limitations of respirators;

(*d*) The purpose and description of the medical surveillance program required by paragraph (k) of this section; and

(*e*) A review of this standard.

(2) *Access to Training Materials.* (i) The employer shall make a copy of this standard and its appendixes readily available to all affected employees.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the Secretary and the Director.

(m) *Signs and labels*—(1) *General.* (i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to or in combination with, signs and labels required by this paragraph.

(ii) The employer shall assure that no statement appears on or near any sign or label required by this paragraph which contradicts or detracts from the required sign or label.

(2) *Signs.* (i) The employer shall post signs to clearly indicate all work areas where DBCP may be present. These signs shall bear the legend:

DANGER

1,2-Dibromo-3-chloropropane

(Insert appropriate trade or common names)

CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

(ii) Where airborne concentrations of DBCP exceed the permissible exposure limits, the signs shall bear the additional legend:

RESPIRATOR REQUIRED

(3) *Labels.* (i) The employer shall assure that precautionary labels are affixed to all containers of DBCP and of products containing DBCP, and that the labels remain affixed when the DBCP or products containing DBCP are sold, distributed, or otherwise leave the employer's workplace. Where DBCP or products containing DBCP are sold, distributed or otherwise leave the employer's workplace bearing appropriate labels required by EPA under the regulations in 40 CFR Part 162, the labels required by this paragraph need not be affixed.

(ii) The employer shall assure that the precautionary labels required by this paragraph are readily visible and legible. The labels shall bear the following legend:

DANGER

1,2-Dibromo-3-chloropropane

CANCER HAZARD

(n) *Recordkeeping*—(1) *Exposure monitoring.* (i) The employer shall establish and maintain an accurate record of all monitoring required by paragraph (e) of this section.

(ii) This record shall include:

(*a*) The dates, number, duration and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

(*b*) A description of the sampling and analytical methods used;

(*c*) Type of respiratory worn, if any; and

(*d*) Name, social security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for the effective period of this emergency temporary standard and for any additional period required by the permanent standard.

(2) *Medical surveillance.* (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by paragraph (k) of this section.

(ii) This record shall include:

(*a*) A copy of the physician's written opinion.

(*b*) Any employee medical complaints related to exposure to DBCP;

(*c*) A copy of the information provided the physician as required by paragraph (k)(3) of this section; and

(*d*) A copy of the employee's work history.

(iii) The employer shall assure that this record be maintained for the effective period of this emergency temporary standard and for any additional time required by the permanent standard.

(3) *Availability.* (i) The employer shall assure that all records required to be maintained by this section be made available upon request to the Secretary and the Director for examination and copying.

(ii) The employer shall assure that employee exposure monitoring records required by this section be made available upon request, for examination and copying to the affected employee or former employee, and their designated representatives.

(iii) The employer shall assure that employee medical records required to be maintained by this section be made available, upon request, for examination and copying to the affected employee or former employee, or to a physician designated by the affected employee or former employee or designated representative.

(o) *Observation of monitoring*—(1) *Employee observation.* The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to DBCP conducted under paragraph (e) of this section.

(2) *Observation procedures.* (i) Whenever observation of the measuring or monitoring of employee exposure to DBCP requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring or measurement, observers shall be entitled to:

(*a*) Receive an explanation of the measurement procedures;

(*b*) Observe all steps related to the measurement of airborne concentrations of DBCP performed at the place of exposure; and

(*c*) Record the results obtained.

(p) *Effective date.* This section shall become effective September 9, 1977.

(q) *Appendices.* The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

APPENDIX A—SUBSTANCE SAFETY DATA SHEET FOR DBCP

I. SUBSTANCE IDENTIFICATION

A. Synonyms and trade names: DBCP; Dibromochloropropane; Fumazone (Dow Chemical Co. TM); Nemafume; Nemagon (Shell Chemical Co. TM); Nemaset; BBC 12; and OS 1879.

B. DBCP can be found as a: Concentrate; liquid; solution; and granules;

C. DBCP is used on crops including: cotton; soybeans; fruits; nuts; vegetables; and ornamentals.

D. DBCP can be applied to crops: Before planting; during planting; and after planting.

E. Permissible exposure: Exposure may not exceed either:

1. 10 parts DBCP per billion parts of air (10 ppb) averaged over the eight-hour work day; or

2. 50 parts DBCP per billion parts of air (50 ppb) averaged over any 15 minute period in the workday.

II. HEALTH HAZARD DATA

A. Routes of entry: Employees may be exposed:

1. Through inhalation (breathing);
2. Through ingestion (swallowing);
3. Skin contact; and
4. Eye contact.

B. Effects of overexposure:

1. Short-term exposure: DBCP may cause drowsiness, irritation of the eyes, nose, throat and skin, nausea and vomiting. In addition, overexposure may cause damage to the lungs, liver or kidneys.

2. Long-term exposure: Prolonged or repeated exposure to DBCP may cause injury to the lungs, liver or kidneys. DBCP has been associated with sterility in humans and laboratory animals. It also has been shown to produce cancer in laboratory animals.

3. Reporting Signs and Symptoms: If you develop any of the above signs or symptoms that you think are caused by exposure to DBCP, you should inform your employer.

III. EMERGENCY FIRST AID PROCEDURES

A. *Eye exposure.* If DBCP liquid or dust containing DBCP gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with DBCP.

B. *Skin exposure.* If DBCP liquids or dusts containing DBCP get on your skin, immediately wash using soap or mild detergent and water. If DBCP liquids or dusts containing DBCP penetrate through your clothing, remove the clothing immediately and wash. If irritation is present after washing get medical attention.

C. *Breathing.* If you or any person breathe in large amounts of DBCP, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Do not use mouth-to-mouth. Keep the affected person warm and at rest. Get medical attention as soon as possible.

D. *Swallowing.* When DBCP has been swallowed and the person is conscious, give the person large amounts of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

E. *Rescue.* Notify someone. Put into effect the established emergency rescue procedures. Know the locations of the emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

A. *Respirators.* You may be required to wear a respirator for non-routine activities or in emergencies and while your employer is in the process of reducing DBCP exposures through engineering controls. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines Approval label). For effective protection, a respirator must fit your face and head snugly. The respirator should not be loosened or removed in work situations where its use is required. DBCP does not have a detectable odor except at 300 times or more above the permissible exposure limit. Do not depend on odor to warn you when a respirator cartridge or canister is exhausted. Cartridges or canisters must be changed daily. Re-use of these may allow DBCP to gradually filter through the cartridge and cause exposures which you cannot detect by odor. If you can smell DBCP while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

B. *Protective Clothing.* You should wear impervious coveralls or similar fullbody work clothing, gloves, headcoverings, boots or shoe coverings to avoid contact with liquid or dust containing DBCP. Standard rubber and neoprene gloves do not offer adequate protection.

DBCP should never be allowed to remain on the skin. Clothing and shoes should not be allowed to become contaminated with the material, and if they do, they should be promptly removed and not worn again until completely free of the material. Turn in impervious clothing that has developed leaks for repair or replacement.

C. *Eye protection.* You must wear splash-proof safety goggles where there is any possibility of DBCP liquid or dust contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING, AND STORAGE

A. DBCP must be stored in tightly closed containers in a cool, well-ventilated area.

B. If your work clothing may have become contaminated with DBCP, or liquids or dusts containing DBCP, you must change into uncontaminated clothing before leaving the work premises.

C. You must promptly remove any non-impervious clothing that becomes contaminated with DBCP. This clothing must not be reworn until the DBCP is removed from the clothing.

D. If your skin becomes contaminated with DBCP, you must promptly and thoroughly wash or shower with soap or mild detergent and water to remove any DBCP from your skin.

E. You must not keep food, beverages, or smoking materials, nor eat or smoke, in areas where DBCP is handled, processed or stored.

F. If you handle DBCP, you must wash your hands thoroughly with soap or mild detergent and water, before eating, smoking or using toilet facilities.

G. Ask your supervisor where DBCP is used in your work area and for any additional safety and health rules.

VI. ACCESS TO INFORMATION

A. Each year, your employer is required to inform you of the information contained in this Substance Safety Data Sheet for DBCP. In addition, your employer must instruct you in the safe use of DBCP, emergency procedures, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to DBCP. You or your representative have the right to observe employee exposure measurements and to record the result obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he is required to inform you of the actions which are being taken to reduce your exposure.

C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure and medical data for at least the effective period of this emergency temporary standard.

D. Your employer is required to release exposure and medical records to your physician upon your written request.

APPENDIX B—SUBSTANCE TECHNICAL GUIDELINES FOR DBCP

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification.

1. Synonyms: 1,2-dibromo-3-chloropropane; DBCP, Fumazone; Nemafume; Nemagon; Nemaset; BBC 12; OS 1879. DBCP is also included in agricultural pesticides and fumigants which include the phrase "Nema ------" in their name.

2. Formula: C3H5Br2 Cl

3. Molecular Weight: 236

B. Physical Data.

1. Boiling point (769 mm Hg): 195C (383F)

2. Specific gravity (water=1): 2.093

3. Vapor density (air=1 at boiling point of DBCP): Data not available

4. Melting point: 6C (43F)

5. Vapor pressure at 20C (68F): 0.8 mm Hg

6. Solubility in water: 1000 ppm

7. Evaporation rate (Butyl Acetate=1): very much less than 1

8. Appearance and odor: Dense yellow or amber liquid with a pungent odor at high concentrations. Any detectable odor of DBCP indicates overexposure.

II. FIRE EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire.

1. Flash point: 170 F TOC.

2. Autoignition temperature: Data not available.

3. Flammable limits in air, % by volume: Data not available.

4. Extinguishing media: Carbon dioxide, dry chemical.

5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.

6. Unusual fire and explosion hazards: None known.

7. For purposes of complying with the requirement of 29 CFR 1910.106, liquid DBCP is classified as a class III A combustible liquid.

8. For the purpose of complying with 29 CFR 1910.309, the classification of hazardous locations as described in article 500 of the National Electrical Code for DBCP shall be class I group D.

9. For the purpose of compliance with § 1910.157, DBCP is classified as a Class B fire hazard.

10. For the purpose of ocmpliance with § 1910.178, locations classified as hazardous locations due to the presence of DBCP shall be Cass I, Group D.

11. Sources of ignition such as smoking or open flames are prohibited where DBCP presents a fire or explosion hazard.

B. Reactivity

1. Conditions contributing to instability: None known.

2. Incompatibilities: Reacts with chemically active metals, such as aluminum, magnesium and tin alloys.

3. Hazardous decomposition products: Toxis gases and vapors (such as HBr, HCl and carbon monoxide) may be released in a fire involving DBCP.

4. Special precautions: DBCP will attack some rubber materials and coatings.

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If DBCP is spilled or leaked, the following steps should be taken:

1. The area should be evacuated at once and re-entered only after thorough ventilation.

2. Ventilate area of spill or leak.

3. If in liquid form, collect for reclamation or absorb in paper, vermiculite, dry sand, earth or similar material.

4. If in solid form, collect spilled material in the most convenient and safe manner for reclamation or for disposal.

B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

C. Waste disposal methods:

1. For small quantities of liquid DBCP absorb on paper towels, remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. If liquid DBCP is absorbed in vermiculite, dry sand, earth or similar material and placed in sealed containers it may be disposed of in a state-approved sanitary landfill.

2. If in solid form, for small quantities place on paper towels, remove to a safe place (such as a fume hood) and burn. Large quantities may be reclaimed. However, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with

an appropriate effluent gas cleaning device. DBCP in solid form may also be disposed in a state approved sanitary landfill.

IV. MONITORING AND MEASUREMENT PROCEDURES

A. Exposure above the Permissible Exposure Limit.

1. *Eight hour exposure evaluation.* Measurements taken for the purpose of determining employee exposure under this section are best taken so that the average eight-hour exposure may be determined from a single 8-hour sample or two (2) four-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

2. *Ceiling Evaluation.* Measurements taken for the purpose of determining employee exposure under this section must be taken during periods of maximum expected airborne concentrations of DBCP in the employee's breathing zone. A minimum of three measurements should be taken on one work shift. The highest of all measurements taken is an estimate of the employee's exposure.

3. *Monitoring Techniques.* The sampling and analysis under this section may be performed by collecting the DBCP vapor on charcoal adsorption tubes with subsequent chemical analyses. The method of measurement chosen should determine the concentration or airborne DBCP to an accuracy of plus or minus 25%. If charcoal tubes are used a total volume of 10 liters should be collected at a flow rate of 50 cc. per minute for each tube. Analyse the resultant samples as you would samples of halogenated solvent.

C. Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. PROTECTIVE CLOTHING

Employees should be provided with and required to wear appropriate protective clothing to prevent any possibility of skin contact with DBCP. Because DBCP is absorbed through the skin, it is important to prevent skin contact with both liquid and solid forms of DBCP. Protective clothing should include impermeable coveralls or similar fullbody work clothing, gloves, headcoverings, and workshoes or shoe coverings. Standard rubber and neoprene gloves do not offer adequate protection and should not be relied upon to keep DBCP off the skin. DBCP should never be allowed to remain on the skin. Clothing and shoes should not be allowed to become contaminated with the materials, and if they do, they should be promptly removed and not worn again until completely free of the material. Any protective clothing which has developed leaks or is otherwise found to be defective should be repaired or replaced. Employees should also be required to wear splash-proof safety goggles where there is any possibility of DBCP contacting the eyes.

VI. HOUSEKEEPING AND HYGIENE FACILITIES

For purposes of complying with 29 CFR 1910.141 the following items should be emphasized:

1. The workplace should be kept clean, orderly and in a sanitary condition;

2. Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surfaces where DBCP dust or liquids are found. To minimize the contamination of air with dust, vacuuming with either portable or permanent systems may be used. If a portable unit is selected, the exhaust should be attached to the general workplace exhaust ventilation system, or collected within the vacuum unit equipped with high efficiency filters or other appropriate means of contamination removal and not used for other purposes. Units used to collect DBCP should be labeled as prescribed in § 1910.1044(m) (DBCP standard).

3. Adequate washing facilities with hot and cold water should be provided, and maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of DBCP from the skin.

4. Change or dressing rooms with individual clothes storage facilities should be provided to prevent the contamination of street clothes with DBCP. Because of the hazardous nature of DBCP, contaminated protective clothing should be stored in closed containers for cleaning or disposal.

VII. MISCELLANEOUS PRECAUTIONS

A. Store DBCP in tightly closed containers in a cool, well ventilated area.

B. Use of supplied-air suits or other impervious clothing (such as acid suits) may be necessary to prevent skin contact with DBCP. Supplied-air suits should be selected, used, and maintained under the supervision of persons knowledgeable of limitations and potential life-endangering characteristics of supplied-air suits.

C. Advise employees of all areas and operations where exposure to DBCP could occur.

VIII. COMMON OPERATIONS

Common operations in which exposure to DBCP is likely to occur are: During its production; formulation into pesticides and fumigants; application of such pesticides and fumigants; and work in areas where such pesticides and fumigants have been applied, and processing of agricultural products containing residues of DBCP.

APPENDIX C—MEDICAL SURVEILLANCE GUIDELINES FOR DBCP

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

Recent data collected on workers involved in the manufacture and formulation of DBCP has shown that exposures to DBCP can cause sterility. This finding is supported by studies showing that DBCP causes sterility in animals. Chronic exposure to DBCP resulted in pronounced necrotic action on the parenchymatous organs (i.e., liver, kidney, spleen) and on the testicles of rats. Rats that were chronically exposed to DBCP also showed changes in the composition of the blood, showing low RBC, hemoglobin, and WBC, and high reticulocyte levels as well as functional hepatic disturbance, manifesting itself in a long prothrombin time. Reznik et al. noted a single dose of 100 mg produced profound depression of the nervous system of rats. Their condition gradually improved. Acute exposure also resulted in the destruction of the sex gland activity of male rats as well as causing changes in the estrous cycle in female rats. Animal studies has also associated DBCP with an increased incidence of carcinoma. Olson et al. orally administered DBCP to rats and mice 5 times per week at experimentally predetermined maximally tolerated doses and at half those doses. As early as ten weeks after initiation of treatment, DBCP induced a high incidence of squamous cell carcinomas of the stomach with metastases in both species. DBCP also induced mammary adenocarcinomas in the female rats at both dose levels.

III. SIGNS AND SYMPTOMS

A. Inhalation: Nausea, eye irritation, conjunctivitis, respiratory irritation, pulmonary congestion or edema, CNS depression with apathy, sluggishness, and ataxia.

B. Dermal: Erythema or inflammation and dermatitis on repeated exposure.

IV. SPECIAL TESTS

1. Complete semen analysis (sperm count, motility, morphology);
2. Complete urinalysis;
3. Complete blood count;
4. Serum Multiphasic Analysis (SMA 12);
6. Serum testosterone;
7. Serum Follicle Stimulating Hormone (FSH); and
8. Serum Luteinizing Hormone (LH).

V. TREATMENT

Remove from exposure immediately, give oxygen or artificial resuscitation if indicated. Contaminated clothing and shoes should be removed immediately.

Flush eyes and wash contaminated skin. If swallowed and the person is conscious, induce vomiting. Recovery from mild exposures is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. *Other considerations.* DBCP can cause both acute and chronic effects.

It is important that the physician become familiar with the operating conditions in which exposure to DBCP occurs. Those with respiratory disorders may not tolerate the wearing of negative pressure respirators.

B. *Surveillance and screening.* Medical histories and laboratory examinations are required for each employee subject to exposure to DBCP. The employer should screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from exposure.

1. *Liver disease.* The primary site of biotransformation and detoxification of DBCP is the liver.

Liver dysfunctions likely to inhibit the conjugation reactions will tend to promote the toxic actions of DBCP. These precautions should be considered before exposing persons with impaired liver function to DBCP.

2. *Renal disease.* Because DBCP has been associated with injury to the kidney it is important that special consideration be given to those with possible impairment of renal function.

3. *Skin disease.* DBCP can penetrate the skin and can cause erythema on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of DBCP.

4. *Blood dyscrasias.* DBCP has been shown to decrease the content of erythrocytes, hemoglobin, and leukocytes in the blood, as well as increase the prothrombin time. Persons with existing blood disorders may be more susceptible to the effects of DBCP.

5. *Reproductive disorders.* Animal studies have associated DBCP with various effects on the reproductive organs.

Among these effects are atrophy of the testicles and changes in the estrous cycle. Persons with pre-existing reproductive disorders may be at increased risk to these effects of DBCP.

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[FR Doc.77-26368 Filed 9-8-77;2:00 pm]